

[CLAIMS]

[Claim 1] A drum type washing machine comprising:

5 a tub of plastic having a wall portion for holding washing water and securing a driving unit thereto, and a front side sloped upward at a predetermined angle from ground;

a drum rotatably mounted in the tub;

a hollow drum shaft passed through the tub, and connected to the drum inside of the tub for transmission of driving power from a motor to the drum;

10 at least one bearing for supporting the hollow drum shaft;

a stator fixedly secured to the rear wall portion of the tub;

a rotor connected to a rear end of the drum shaft to constitute a motor together with the stator;

a pulsator rotatably mounted in the drum;

15 a pulsator shaft mounted to pass through the hollow of the drum shaft, having a fore end connected to the pulsator; and

pulsator control means for braking/releasing rotation of the rotation of the pulsator.

20 [Claim 2] The drum type washing machine as claimed in claim 1, wherein the pulsator control means includes;

a pulley in rear of the rotor connected to a rear end of the pulsator shaft, for controlling rotation of the pulsator, and

25 a braking device for controlling rotation of the pulsator in the drum by braking/releasing the pulley.

[Claim 3] The drum type washing machine as claimed in claim 1, wherein the

pulsator shaft is supported on oilless bearings on a front side and a rear side thereof.

[Claim 4] The drum type washing machine as claimed in claim 1, wherein the
at least one bearing for supporting the hollow drum shaft includes one on a front side,
5 and the other one on a rear side of the drum shaft.

[Claim 5] The drum type washing machine as claimed in claim 4, wherein, of
the bearings supporting the hollow drum shaft, the front side bearing of the drum shaft
has a diameter grater than a diameter of the rear side bearing for minimizing vibration
10 of the drum during spinning, and making strength higher.

[Claim 6] The drum type washing machine as claimed in claim 4, further
comprising a water seal in front of the front side bearing of the drum shaft, for
preventing water from leaking.

15 [Claim 7] The drum type washing machine as claimed in claim 6, wherein the
water seal includes a spring mounted therein for compressing the water seal.

[Claim 8] The drum type washing machine as claimed in claim 6, wherein an
20 outside portion of the water seal is supported on a bearing housing, or a shape of the
rear wall of the tub.

[Claim 9] The drum type washing machine as claimed in claim 2, wherein the
braking device includes;
25 a solenoid secured to the tub,
a plunger moving back and forth in the solenoid, and
a compression spring in the solenoid for providing force to move the plunger

forward,

so that the plunger brakes or releases the pulley depending on electric turn on/off of the solenoid, for braking/releasing rotation of the pulsator.

5 [Claim 10] The drum type washing machine as claimed in claim 2, wherein the braking device includes;

a solenoid secured to a cabinet which encloses the tub,

a plunger moving back and forth in the solenoid, and

a compression spring in the solenoid for providing force to move the plunger

10 forward,

so that the plunger brakes or releases the pulley depending on electric turn on/off of the solenoid, for braking/releasing rotation of the pulsator.

[Claim 11] The drum type washing machine as claimed in claim 1, further
15 comprising a rotor bushing between the drum shaft and the rotor.

[Claim 12] The drum type washing machine as claimed in claim 11, wherein the rotor bushing couples to the drum shaft and the rotor frame in a state the rotor bushing is positioned in rear, or front of a rotor frame.

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[Claim 13] The drum type washing machine as claimed in claim 12, wherein the rotor bushing includes;

an engagement portion at a center thereof for placing in, and engagement with the drum shaft, and

25 a coupling portion extended in a radial direction from a circumference of the engagement portion for coupling with the rotor frame.

[Claim 14] The drum type washing machine as claimed in claim 13, wherein the coupling portion of the rotor bushing includes positioning projections projected toward the rotor frame as one body.

[Claim 15] The drum type washing machine as claimed in claim 14, wherein
5 the coupling portion of the rotor bushing includes fastening pass through holes for fastening to the rotor frame with bolts.

[Claim 16] The drum type washing machine as claimed in claim 14, wherein the rotor bushing further includes a reinforcing rib at least one of the engagement
10 portion or the coupling portion.

[Claim 17] The drum type washing machine as claimed in claim 14, wherein the drum shaft includes a serration on an outside circumferential surface of a rear end portion of 6, and the rotor bushing includes a serration on an inside circumferential
15 surface of a center of the engagement portion of the rotor bushing opposite to the serration of the drum shaft, for engagement with each other.

[Claim 18] The drum type washing machine as claimed in claim 14, wherein the rotor bushing is formed of plastic.
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[Claim 19] The drum type washing machine as claimed in claim 1, further comprising:

a spider 16 secured the rear wall of the drum for supporting the rear wall of the drum and reinforcing the strength, and

25 a flange at a front end portion of the drum shaft in close contact with the spider, for fastening the drum rear wall, the spider, and the flange of the drum shaft with fastening members passed therethrough, together.

[Claim 20] The drum type washing machine as claimed in claim 1, wherein the pulsator shaft includes serrations at opposite ends for engagement with the pulsator and the pulley.

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[Claim 21] The drum type washing machine as claimed in claim 20, wherein the serration includes an involute profile surface.

[Claim 22] The drum type washing machine as claimed in claim 1, wherein the motor is a BLDC motor.

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[Claim 23] The drum type washing machine as claimed in claim 9, wherein the pulley includes;

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a portion for covering the rear wall of the rotor frame,
a portion for covering a sidewall of the rotor frame,
an engagement portion at a center of the rear wall portion 15a for engagement with the pulsator shaft, and
a holding recess in the pulley at a portion covering the rotor frame for being held by the braking device.

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[Claim 24] The drum type washing machine as claimed in claim 23, wherein the engagement portion of the pulley includes a projected boss shape for placing, and being positioned inside of the rear end of the drum shaft in assembly.

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[Claim 25] The drum type washing machine as claimed in claim 6, wherein the drum shaft is formed of an SM45 group material.

[Claim 26] The drum type washing machine as claimed in claim 25, wherein the drum shaft includes a surface plated with chrome for reducing wear, and friction, and enhancing corrosion resistance of the drum shaft.

5 [Claim 27] The drum type washing machine as claimed in claim 26, wherein the chrome is plated at least on a surface sliding with the water seal or the like of the drum shaft.

[Claim 28] The drum type washing machine as claimed in claim 6, wherein the
10 drum shaft is formed of stainless steel for reducing wear, and friction of a sliding surface between the water seal and the drum shaft, and enhancing corrosion resistance of the drum shaft.

[Claim 29] The drum type washing machine as claimed in claim 1, further
15 comprising washing fins so that the laundry hits the washing fin to increase friction when the laundry lifted up by the rotation of the drum drops, and making the laundry to move in back and forth.

[Claim 30] The drum type washing machine as claimed in claim 29, wherein
20 the washing fins at regular intervals on the main surface of the pulsator are formed as one body with the main surface of the pulsator.

[Claim 31] The drum type washing machine as claimed in claim 29, wherein the washing fin includes at least one sloped surface with respect to a radial direction, or
25 a circumferential direction of the pulsator.

[Claim 32] The drum type washing machine as claimed in claim 29, wherein

the main surface of the pulsator has a predetermined curvature.

[Claim 33] The drum type washing machine as claimed in claim 29, wherein the washing fins of the pulsator has a maximum height of 5 ~ 15% of an outside diameter of the pulsator.

[Claim 34] The drum type washing machine as claimed in claim 1, wherein the pulsator has an outside diameter of around 50 ~ 80% of an inside diameter of the drum.

[Claim 35] The drum type washing machine as claimed in claim 1, wherein the drum and the tub have axes tilted by 10 ~ 30° from ground.

[Claim 36] The drum type washing machine as claimed in claim 35, further comprising a pulsator rotatably mounted on an inside circumferential surface of the drum.

[Claim 37] The drum type washing machine as claimed in claim 1, further comprising a plurality of lifters on the inside circumferential surface of the drum for lifting up the laundry during washing, the lifters spaced away from the pulsator by approx. 30 ~ 90mm.

[Claim 38] The drum type washing machine as claimed in claim 1, further comprising auto-balancers mounted on a front and a rear of the drum for reducing vibration in spinning, respectively.

[Claim 39] The drum type washing machine as claimed in claim 38, wherein the auto-balancer has a ring shape with a single fluid chamber.

[Claim 40] The drum type washing machine as claimed in claim 38, wherein the auto-balancers are arranged to form concentric circles, at least double structured.

5 [Claim 41] The drum type washing machine as claimed in claim 40, wherein the auto-balancer has a height greater than a width.

[Claim 42] A drum type washing machine comprising:

10 a tub of plastic having a wall portion for holding washing water and securing a driving unit thereto, and a front side sloped upward at a predetermined angle from ground;

 a drum rotatably mounted in the tub;

 lifters on an inside circumferential surface of the drum;

15 a hollow drum shaft passed through the tub, and connected to the drum inside of the tub for transmission of driving power from a motor to the drum;

 at least one bearing for supporting the hollow drum shaft;

 a sleeve shaped bearing housing for supporting the bearing;

 a stator fixedly secured to the rear wall portion of the tub;

 a rotor bushing of an insulating material secured to a rear end of the drum shaft;

20 a rotor secured to the rotor bushing for transmission of driving force to the drum shaft through the rotor bushing;

 a rotor secured to a rear end of the drum shaft to constitute a BLDC motor together with the stator;

25 a pulsator rotatably mounted on an inside of the drum, having curved shape of washing fins on a main surface thereof;

 a pulsator shaft mounted to pass through the hollow of the drum shaft, having a fore end connected to the pulsator;

a pulley positioned in rear of the rotor, and coupled to a rear end of the pulsator shaft, for controlling rotation of the pulsator; and

a braking device including;

a solenoid secured to the tub,

5 a plunger moving back and forth in the solenoid,

so that the plunger brakes or releases the pulley depending on electric turn on/off of the solenoid, for braking/releasing rotation of the pulsator.

[Claim 43] A method for controlling a tilted drum type washing machine, in
10 which rotation of a pulsator in a drum is controlled by braking/releasing a pulsator rotation control pulley, comprising the steps of:

performing washing in a state the pulsator is held; and

performing washing in a state the pulsator is released to rotate freely.

15 [Claim 44] The method as claimed in claim 43, further comprising the step of performing soft washing by controlling an alternating time period of the drum to be a short time in which the laundry does not drop in a state the pulsator is held or released in washing.

20 [Claim 45] The method as claimed in claim 43, further comprising the steps of:
performing spinning in a state the pulsator is held; and
performing spinning in a state the pulsator is released to rotate, freely.

[Claim 46] A drum type washing machine comprising:

25 a tub of plastic having a wall portion for holding washing water and securing a driving unit thereto, a front side sloped upward at a predetermined angle from ground, a hot air inlet in an upper side of a rear wall, and a hot air outlet in a lower side of a front;

a drum rotatably mounted in the tub, having hot air pass through holes in a rear wall;

a hollow drum shaft passed through the tub, and connected to the drum inside of the tub for transmission of driving power from a motor to the drum;

5 at least one bearing for supporting the hollow drum shaft;

a sleeve shaped bearing housing for supporting the bearing;

a stator fixedly secured to the rear wall portion of the tub;

a rotor connected to a rear end of the drum shaft to constitute a motor together with the stator;

10 a pulsator rotatably mounted in the drum, having hot air supply holes in a main surface thereof;

a pulsator shaft mounted to pass through the hollow of the drum shaft, having a fore end connected to the pulsator;

pulsator control means for braking/releasing rotation of the rotation of the
15 pulsator; and

hot air supply means for supplying hot air into the drum to dry the laundry in the drum.

[Claim 47] The drum type washing machine as claimed in claim 46, wherein
20 the pulsator control means includes;

a pulley in rear of the rotor connected to a rear end of the pulsator shaft, for controlling rotation of the pulsator, and

a braking device for controlling rotation of the pulsator in the drum by braking/releasing the pulley.

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[Claim 48] The drum type washing machine as claimed in claim 46, wherein the hot air supply holes include a plurality of small diametered hot air supply holes for

serving as flow passages to supply hot air into the drum in drying, and preventing damage to the laundry in washing.

[Claim 49] The drum type washing machine as claimed in claim 47, wherein
5 the braking device includes;

a solenoid secured to the tub,

a plunger moving back and forth in the solenoid, and

a compression spring in the solenoid for providing force to move the plunger forward,

10 so that the plunger brakes or releases the pulley depending on electric turn on/off of the solenoid, for braking/releasing rotation of the pulsator.

[Claim 50] The drum type washing machine as claimed in claim 46, wherein the pulsator has an outside diameter of around 50 ~ 80% of an inside diameter of the
15 drum.

[Claim 51] The drum type washing machine as claimed in claim 46, further comprising a plurality of lifters on the inside circumferential surface of the drum for lifting up the laundry during washing, the lifters spaced away from the pulsator by
20 approx. 30 ~ 90mm.

[Claim 52] The drum type washing machine as claimed in claim 46, further comprising auto-balancers mounted on a front and a rear of the drum for reducing vibration in spinning, respectively.

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[Claim 53] The drum type washing machine as claimed in claim 46, wherein the hot air supply means includes;

a drying duct secured to one side of an upper side of the rear wall of the tub, having a heater and a fan mounted in a flow passage therein, for production and forced supply of hot air, and

5 a condensing duct for removing moist from the hot air discharged through the hot air outlet in a lower portion of the front of the tub.

[Claim 54] A method for controlling a tilted drum type washing machine, in which rotation of a pulsator in a drum is controlled by braking/releasing a pulsator rotation control pulley, comprising the steps of:

10 performing washing in a state the pulsator is released to rotate freely;
performing spinning in a state the pulsator is released to rotate freely; and
performing drying in a state the pulsator is released to rotate freely.

[Claim 55] The method as claimed in claim 54, further comprising at least one
15 of the steps of:

performing washing in a state the pulsator is held;
performing spinning in a state the pulsator is held; and
performing drying in a state the pulsator is held.

20 [Claim 56] The method as claimed in claim 55, further comprising the step of performing soft washing by controlling an alternating time period of the drum to be a short time in which the laundry does not drop in a state the pulsator is held or released in washing.